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Galerella nigeriensis (*Agaricales*), a new species from tropical Africa

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Abstract — A new species, *Galerella nigeriensis,* from southwestern Nigeria is described. It is characterized by a strongly plicate, dry, yellowish to orange brown pileus, whitish veil on pileus and stipe base, white and pubescent stipe, thick-walled, mostly flattened spores, tibiiform to lageniform cheilocystidia, and presence of hymenophysalides (recorded for the first time in the genus *Galerella*). Black and white photographs of basidiomata and microscopic elements accompany the description. *G. nigeriensis* is compared to related species and a worldwide diagnostic key to the genus *Galerella* is provided.

Key words — *Basidiomycota,* biodiversity, *Bolbitiaceae,* mycobiota, taxonomy

Introduction

The third author conducted a field research of Nigerian mycobiota during the rainy season from June to August 2008. Among collected samples, we discovered a new species of *Galerella* that we describe here. *Galerella* Earle is a small genus of the family *Bolbitiaceae* Singer with five already known and well documented species: *G. fibrillosa* Hauskn., *G. floriformis* Hauskn., *G. microphues* (Berk. & Broome) Pegler, *G. plicatella* (Peck) Singer, and *G. plicatelloides* Sarwal & Locq. (see Sarwal & Locquin 1983, Hausknecht & Contu 2003). *Galerella conocephala* (Bull. : Fr.) Bon is considered a doubtful species by Hausknecht & Contu (2003) because of unclear interpretation and the lack of a holotype and recent material. *Galerella* species are saprotrophs, growing mostly on soil, but also on decaying twigs or wood. All species are rare (recorded only once or twice except *G. plicatella*). They are distributed throughout tropical and/or subtropical zone (including Mediterranean area), while *G. plicatella* also occurs

in areas with a continental climate. Morphologically, *Galerella* is characterized by a hymeniform pileipellis, rusty brown spore print, mainly dry and strikingly plicate-sulcate pileus (as in many *Coprinus* species), and by the absence of lecythiform cystidia (Horak 1968, Singer 1986, Hausknecht & Contu 2003). Although most authors consider *Galerella* an independent genus (Horak 1968, 2005, Moser 1983, Pegler 1986, Singer 1986, Bon 1992, Hausknecht & Contu 2003), some authors include *Galerella* in *Conocybe* Fayod s.l. (Watling 1982, as a subgenus) or *Pholiotina* Fayod (Arnolds 2005). In order to better understand the phylogenetic relationships between *Galerella* and related genera, molecular analyses are required.

Materials and methods

The holotype description is based on one collection containing seven basidiomata, which were photographed in the field. Color codes in the macroscopic description (given in brackets) are cited according to Kornerup & Wanscher (1981). Microscopic features were observed using a light microscope (brightfield and phase contrast) with magnification up to 1500× and photographed with a digital camera. Description and photographs of microscopic characters were made from rehydrated dried specimens mounted in 2.5% potassium hydroxide (KOH) solution. Basidiospore color was also observed in H_2O and 10% NH_4OH. Basidiospore measurements were made from the mounts of lamellae and based on calibrated digital photographs: only mature spores (determined by color and appearance) were measured. The width of germ-pore was measured as inner distance between spore walls at the spore apex. A total number of 120 randomly selected basidiospores from two mature basidiomata were measured (60 in frontal view, 60 in side view). Spore measurements are given as: (min.) stat. min. – av. – stat. max. (max), where "min." = minimum (lowest measured value), "stat. min." = statistical minimum (arithmetic average minus two times standard deviation), "av." = arithmetic average, "stat. max." = statistical maximum (arithmetic average plus two times standard deviation), "max." = maximum (highest measured value). Standard deviations (SD) of spore length, breadth, and width are also given. The length/breadth ratio of spores (frontal view) is given as the "Qf" value (min. – av. – max.) and length/width ratio of spores (side view) is given as the "Qs" value (min. – av. – max.). Holotype and accompanied data are deposited at the Croatian National Fungarium in Zagreb (CNF).

The term hymenophysalides is used according to Clémençon (1997, 2004) for sterile, short, turgescent cells that surround the basidia (present in hymenium of some *Agaricales*), also called pseudoparaphyses, brachycystidia, brachybasidioles, or pavement cells. Comparison of *G. nigeriensis* with similar taxa and the diagnostic key of *Galerella* species are based on the descriptions

Figs 1–2. Basidiomata of *Galerella nigeriensis* in situ. Bars = 5 mm.

and illustrations in the following literature: Horak 1968, Sarwal & Locquin 1983, Pegler 1986, Thomas et al. 2001, Horak & Hausknecht 2002, Arnolds

& Hausknecht 2003, Hausknecht & Contu 2003, Hausknecht et al. 2004, Hausknecht 2009.

Taxonomy

Galerella nigeriensis Tkalčec, Mešić & Čerkez, **sp. nov.** Figs 1–10

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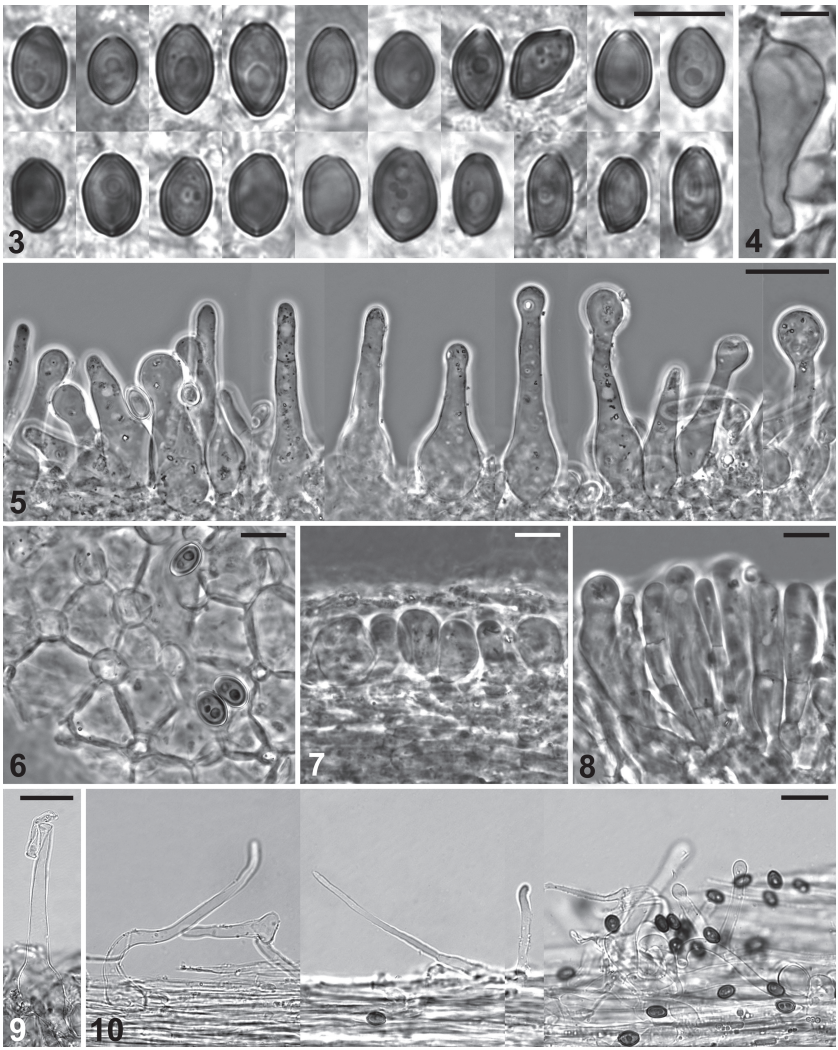
Pileus 14–17 mm latus, valde plicatus, siccus, pallide flavido-brunneus vel aurantio-brunneus. Velum praesens, filamentosum, albicans. Lamellae anguste adnatae, ferrugineae. Stipes 26–32 × 1–1.5 mm, pubescens, albus. Sporae (6.9–)7.3–8.8–10.4(–10.7) × (5.1–)5.3–6.1–6.8(–6.9) × (4.5–)4.6–5.3–6.0(–6.2) µm, plerumque lentiformes, crasse tunicatae, in KOH ferrugineae. Hymenophysalides praesentes, cheilocystidia (25–)30–65 × 8–14(–17) µm, tibiiformia vel lageniformia, pileocystidia et caulocystidia praesentia, fibulae abundantes.

Etymology: The species is named after Nigeria, the country of origin.

Holotype: NIGERIA, ONDO STATE: 11 km NW of Akure, 7°19'28" N, 5°7'31" E, alt. 400 m, 25 Jul 2008, leg. M. Čerkez (CNF 1/5859).

Pileus 14–17 mm broad, broadly ellipsoid to oblong at first, later obtusely conical with a small papilla, pale yellowish brown to light orange brown, with darker, orange brown (6C8) to dark reddish brown (8E8, 9E8, 9F8) center, not hygrophanous, surface dull, dry, strongly plicate-sulcate up to 3/4 of the radius. Veil white or whitish, only in some places light brown, densely fibrillose and covering the whole basidioma at first, in maturity remains at the center of the pileus as small patches and usually at the base of the stipe as a small volva-like remnants. Lamellae narrowly adnate, rather crowded (L = ca. 32, l = 0–3), broad (up to 2 mm), very thin, white at first, later pale to rusty brown, with paler to concolorous, slightly flocculose edge. Stipe 26–32 × 1–1.5 mm, in the lower part gradually thickening to the base (up to 3 mm wide), white to pale cream, entirely densely pubescent, weakly striate lengthwise, dry, fistulose. Context very thin, whitish in stipe, brownish in pileus when moist and whitish on drying. Smell and taste not recorded. Spore print rusty brown.

Basidiospores [120/2/1] (6.9–)7.3–*8.8*–10.4(–10.7) × (5.1–)5.3–*6.1*–6.8(–6.9) × (4.5–)4.6–*5.3*–6.0(–6.2) µm, SD = 0.76 × 0.37 × 0.35, Q_f = 1.29–*1.44*–1.71, Q_s = 1.51–*1.69*–2.02, variable in size and shape, ellipsoid, slightly angular to subhexagonal, ovoid, limoniform or subamygdaliform in frontal view, ellipsoid, oblong or amygdaliform in side view, mostly flattened, thick-walled (0.6–0.9 µm), with central to slightly eccentric, ± truncate, 0.6–1.4 µm wide germ-pore, rusty brown in KOH and NH_4OH, yellow brown in H_2O, non-amyloid and non-dextrinoid. Basidia 18–23 × 8–11 µm, 4-spored, clavate, hyaline, thin-walled, surrounded by 3–5 hymenophysalides. Basidioles narrowly clavate to clavate. Hymenophysalides 16–40 × 11–22(–30) µm, subglobose, sphaeropedunculate, ellipsoid or broadly clavate, hyaline, well



Figs 3–10. *Galerella nigeriensis*. 3. Spores. 4. Basidium (phase contrast). 5. Cheilocystidia (phase contrast). 6. Hymenophysalides and basidia (phase contrast). 7. Pileipellis near margin of the pileus (phase contrast). 8. Pileipellis near center of the pileus (phase contrast). 9. Pileocystidium. 10. Caulocystidia. Bars: 3, 6–8 = 10 µm; 4 = 5 µm; 5, 9, 10 = 20 µm.

developed in mature basidiomata. Lamellar edge almost sterile (basidia very rare). Cheilocystidia (25–)30–65 × 8–14(–17) µm, tibiiform (± 50%) with subcapitate to capitate apex 5–11 µm broad or lageniform with 3–5 µm

wide neck, less often conical, thin-walled to slightly thick-walled (≤0.5 µm), hyaline. Pleurocystidia absent. Hymenophoral trama made of much branched, mostly strongly and irregularly inflated hyphae, hyaline, thin-walled to thick-walled (≤0.8 µm), 1–20(–32) µm wide. Pileipellis a hymeniderm, at the center of the pileus physalo-palisadoderm, regularly formed only in young basidiomata, elements mainly broadly to narrowly clavate, less often ellipsoid, obovoid, subcylindrical or narrowly utriform, 9–50(–63) × 3.5–12(–18) µm, thin-walled, subhyaline. Yellowish brown intracellular pigment present in the subpellis and the upper part of pileal trama. Pileocystidia scattered, lageniform with very long neck to filiform, hyaline, thin-walled, 50–250 × 6–17 µm, upper part 3–5 µm broad. Stipitipellis a cutis, made of parallel, thin-walled, hyaline, 2–10 µm wide hyphae. Caulocystidia very variable in size and shape, 10–330 × 3–15 µm, mostly filiform or lageniform (often with very long neck), but also tibiiform, subcylindrical, clavate, ellipsoid or irregularly shaped, sometimes with horizontally elongated base, thin-walled, hyaline. Veil made of elongated, occasionally branched, thin-walled, hyaline, 1.5–4(–6.5) µm wide hyphae. Clamp connections abundant in all tissues.

Habitat — Gregarious, lignicolous, on a very rotten stump at the edge of a heavily disturbed secondary tropical forest (with *Theobroma cacao, Musa* sp., *Elaeis guineensis*).

Distribution — Known only from the type locality in Nigeria.

Remarks — *Galerella nigeriensis* is characterized by a strongly plicate-sulcate, completely dry, pale yellowish brown to light orange brown pileus with a darker center, whitish veil on pileus and stipe base, white and pubescent stipe, thick-walled, mostly flattened and often somewhat angular basidiospores, tibiiform to lageniform cheilocystidia, and presence of hymenophysalides. Hitherto, hymenophysalides have been recorded only in the genera *Bolbitius* Fr., *Conocybe, Coprinus* Pers. s.l., and *Leucocoprinus* Pat. (Clémençon 2004). Although our new species share this character with all *Bolbitius* and some *Conocybe* species, we placed our taxon in the genus *Galerella* on the basis of its strongly plicate-sulcate and completely dry pileus, well developed universal veil, and the absence of lecythiform cystidia. *Bolbitius* species have viscid pilei and lack universal veils, while *Conocybe* species have smooth or rugulose pilei, lecythiform cystidia, and lack universal veils. On the other hand, the presence of a delicate universal veil that covers the entire pileus in young stages was recorded by Hausknecht & Contu (2003) in three other *Galerella* species (*G. fibrillosa, G. floriformis,* and *G. plicatella*).

Galerella nigeriensis can be easily differentiated from other species in the genus by the presence of hymenophysalides and abundant tibiiform cheilocystidia (lacking in other *Galerella* species). *Pholiotina sulcata* Arnolds

& Hauskn. has until recently been mistaken for *G. plicatella* by European and probably Asian authors due to its pileus that varies from weakly striate to irregularly plicate-sulcate (Arnolds & Hausknecht 2003, Hausknecht 2009, Hausknecht et al. 2009). *Pholiotina sulcata* lacks hymenophysalides, tibiiform cheilocystidia, and a veil. The most important differences among world species of *Galerella* are presented in a diagnostic key.

Key to the world species of *Galerella*

1. Cheilocystidia absent 2
1. Cheilocystidia present, well differentiated, and abundant 3
2. Spores 11–16.5 × 7–10 µm, with germ-pore, thick-walled . . . . . ***G. plicatelloides***
2. Spores 7–11 × 3.5–4 µm, without germ-pore, thin-walled . . . . . ***G. floriformis***
3. Hymenophysalides present and well developed in mature basidiomata, cheilocystidia tibiiform and lageniform (in approximately equal proportion) . . . . . ***G. nigeriensis***
3. Hymenophysalides absent, cheilocystidia not tibiiform (mostly lageniform, only sometimes with slightly broadened apex) 4
4. Cheilocystidia ≤35 µm long, pileus whitish . . . . . ***G. microphues***
4. Cheilocystidia ≤50(–65) µm long, pileus pale yellowish- to orange- or reddish-brown 5
5. Spores thin- to slightly thick-walled, cheilocystidia 6–11(–16.5) µm broad . . . . . ***G. plicatella***
5. Spores distinctly thick-walled, cheilocystidia 10–20 µm broad . . . . . ***G. fibrillosa***

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